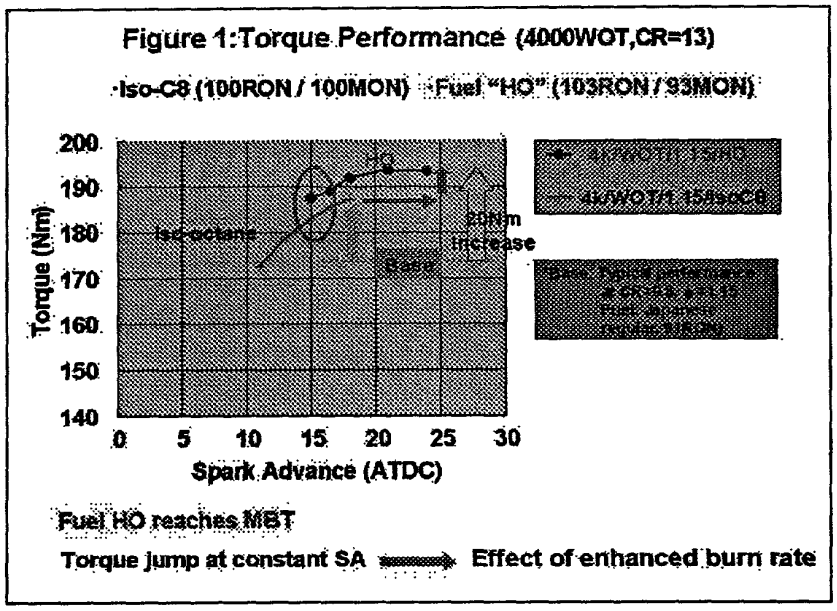


Figure 1:Torque Performance (4000WOT,CR=13)
Iso-C8 (100RON / 100MON)
Fuel "HO" (103RON / 93MON)
Torque (Nm)
200
190
180
170
160
150
140
0
5
10
15
20
25
30
Spark Advance (ATDC)
HO
Iso-octane
Base
20Nm increase
Fuel HO reaches MBT
Torque jump at constant SA
Effect of enhanced burn rate

Figure 2: Efficiency(4000WOT,CR=13)

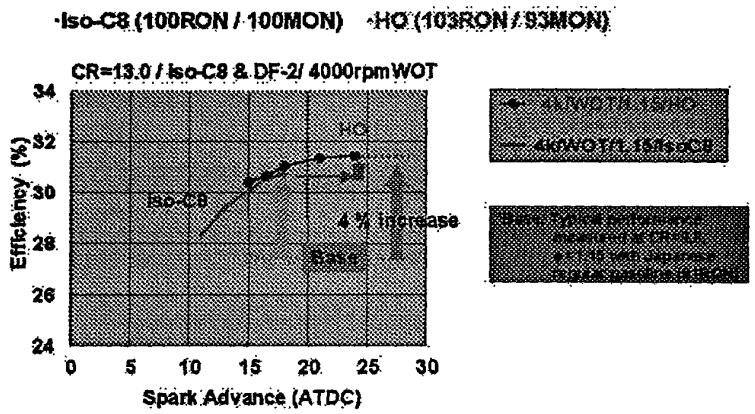
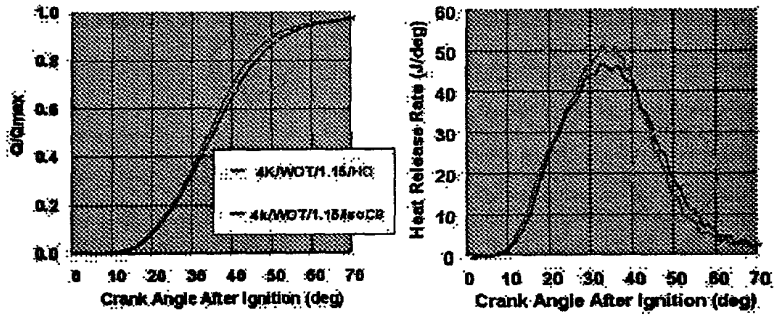


Figure 3: Burn Rate and Heat Release Rate

(4000WOT,CR=13, ϕ=1.15, SA=16.5)



Comb. Period	θ10-50 (deg.)	θ10-90 (deg.)
HO	13.5	29.5
IsoC8	14	31.5
Difference	0.5	2.0

➡ Faster late stage of burn

➡ Corresponds to spark advance of at least ~2 deg.

FIGURE 4

1200 rpm, 12mm3/st: Inj.Timing Dependence - Torque -

Spark Timing: 23 deg.BTDC

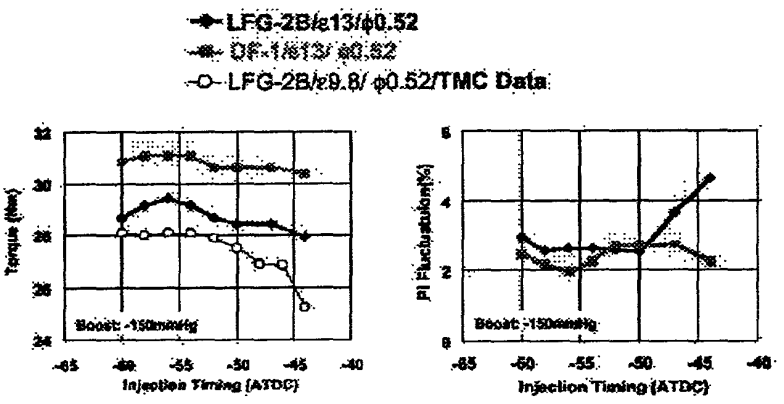


FIGURE 5

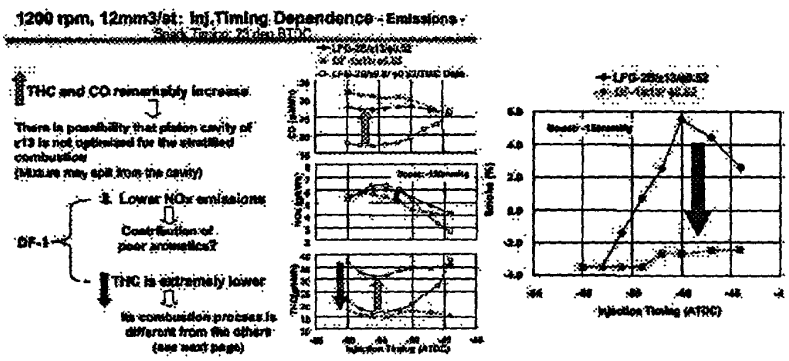
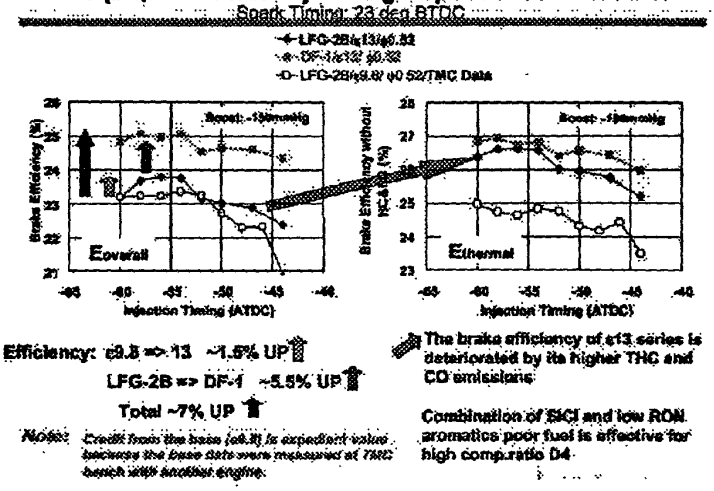


FIGURE 6



Efficiency: ε9.8 => 13 ~1.5% UP

LFG-2B => DF-1 ~5.5% UP

Total ~7% UP

Note: Credit from the base (ε9.8) is expedient value because the base data were measured at TARC bench with another engine.

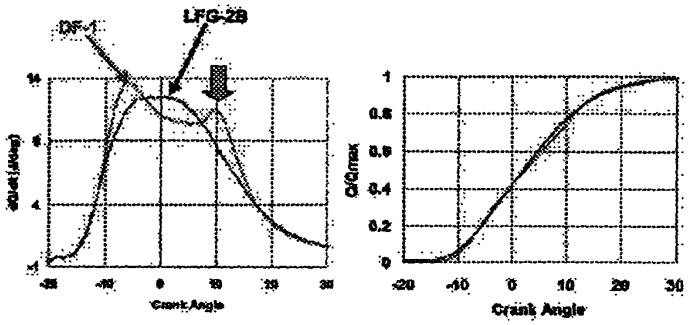
The brake efficiency of ε13 series is deteriorated by its higher THC and CO emissions.

Combination of SICI and low RON aromatics poor fuel is effective for high comp.ratio D4.

FIGURE 7

1200 rpm, 12mm3/st: Heat release patterns

Spark Timing: 23 deg.BTDC, Inj.Timing: 54deg.BTDC



In the case of DF-1 with ε13, SICI (Spark Induced Compression Ignition) is occurred.

FIGURE 8

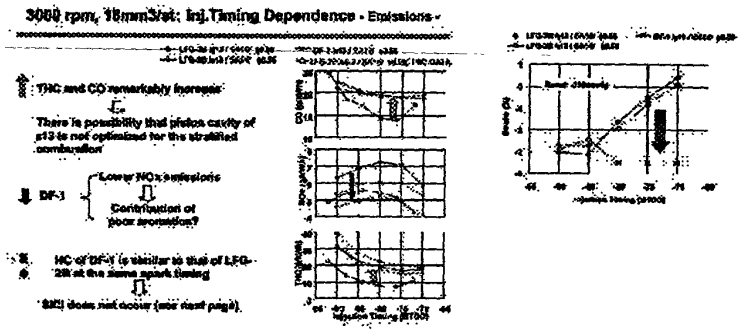
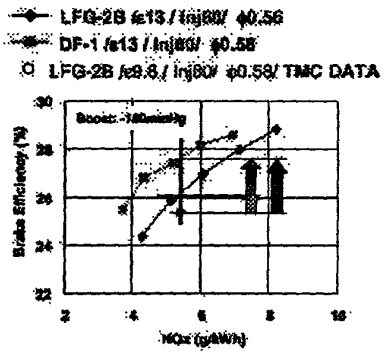


FIGURE 9

3000rpm, 18mm3/st : Credit in Efficiency

Injection Timing: 80 deg.BTDC



Efficiency:

ε9.8 => 13 ~3% UP

LFG-2B => DF-1 ~5% UP
(not under equivalent NOx level)

Total ~8% UP

Above credit is not universal

It is not better way to retard spark timing in order to reduce NOx emissions

FIGURE 10

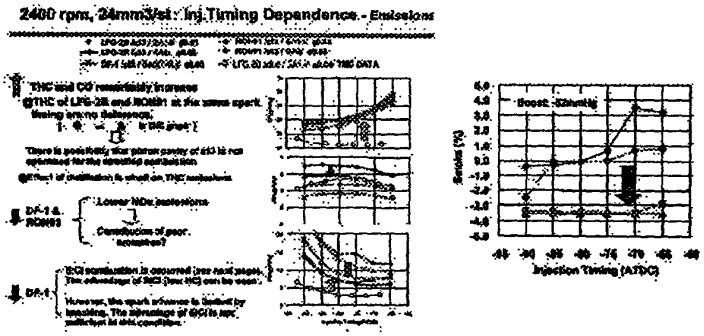
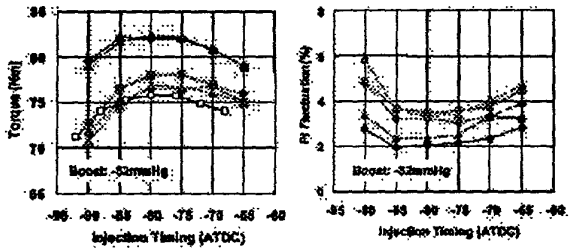


FIGURE 11

2400 rpm, 24mm3/st: Inj.Timing Dependence - Torque -

Equivalent Boost and Φ

LFG-2B /ε13 / SA14/ φ0.63
LFG-2B /ε13 / SA9/ φ0.63
DF-1 /ε13 / SA9(TKL)/ φ0.63
RON91 /ε13 / SA14/ φ0.63
RON91 /ε13 / SA9/ φ0.63
LFG-2B /ε9.8 / SA14/ φ0.64/ TMC DATA

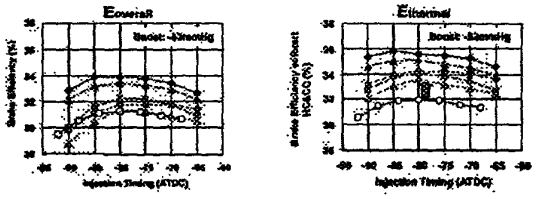


ε13 series shows higher torque

FIGURE 12

2400rpm, 24mm3/st: Inj.Timing Dependence - Efficiencies -

LFG-2B /ε13 / SA14/ φ0.63
LFG-2B /ε13 / SA9/ φ0.63
DF-1 /ε13 / SA9(TKL)/ φ0.63
RON91 /ε13 / SA14/ φ0.63
RON91 /ε13 / SA9/ φ0.63
LFG-2B /ε9.8 / SA14/ φ0.64/ TMC DATA



Credit in efficiency will be discussed on later page

The brake efficiency of ε13 series is deteriorated by its higher THC and CO emissions

FIGURE 13

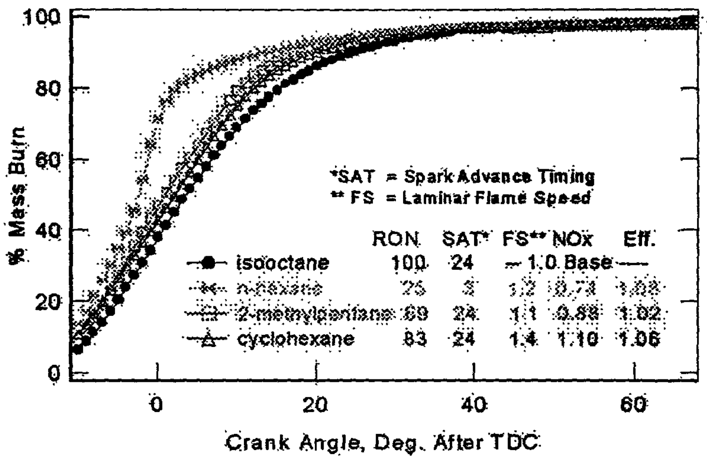
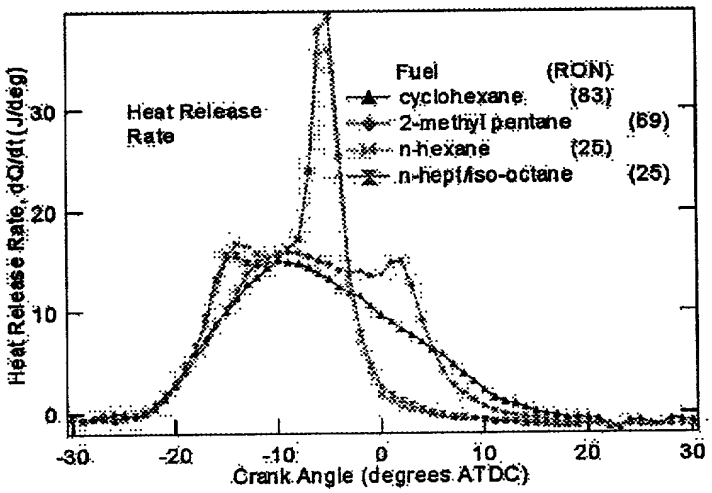

% Mass Burn
100
80
60
40
20
0
Crank Angle, Deg. After TDC
0
20
40
60
*SAT = Spark Advance Timing
** FS = Laminar Flame Speed
RON SAT* FS** NOx Eff.
isooctane 100 24 — 1.0 Base —
cyclohexane 83 24 1.4 1.10 1.06

FIGURE 14


Heat Release Rate
Fuel (RON)
cyclohexane (83)
2-methyl pentane (69)
n-hexane (25)
n-hept/iso-octane (25)
Heat Release Rate, dQ/dt (J/deg)
30
20
10
0
-30
-20
-10
0
10
20
30
Crank Angle (degrees ATDC)